Space Weather Technical Forecast

Issued on Friday 15 November 2024 at 13:06 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Isolated R1/R2 radio blackouts possible. Slight chance of G1/Minor Geomagnetic Storm intervals.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate during the past 24-hours with the peak flare a M1.1 flare peaking at 15/0146 UTC from AR3893.

There are four sunspot regions on the visible disc. The intermediate spots within AR3889 has increasingly diminished, although small delta spots remain possible, with the apparent simplification of this region continuing, now classified Fko/Beta-Delta. The remaining regions all remain small and simple.

No CMEs observed over the past 24 hours are considered to have an Earth-directed component.

Solar Wind / Geomagnetic Activity: Solar winds at L1 measured by ACE were indicative of a weak high speed stream, reaching between 360-420km/s. Density below average. The interplanetary magnetic field (IMF), Bt, initially persistently moderate, with a peak around 13nT, saw a very gradual decline towards weak levels. The north-south component, Bz was predominantly negative at weak to moderate levels. The phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 2-3), with an Active (Kp 4) interval 14/1800-2100 UTC.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 remained at background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was at low to moderate levels. The associated 24-hour fluence remained below the Active threshold. The integrated flux observed at 15/0000 UTC was 3.786e6.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity expected, with a chance of M-class flares and a slight chance of X-class flares, mostly from AR3889.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast.

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Background to slightly elevated solar wind speeds are expected, although from late Day 3 (17th) there is a chance of elevated wind speeds of around 500km/s occurring with a further connection to a HSS. Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 2-3) initially, with a chance of Active (Kp 4) intervals and a slight chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals. From later Day 3 (17 Nov) activity activity expected to increase slightly, becoming Unsettled to Active (Kp 3-4) with an increased chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is at background levels. There is a slight chance of S1/Minor solar radiation storms due to the potential for flaring from AR3889 as it rotates across the western hemisphere.

The high energy electron flux is expected to remain at predominantly background to moderate levels, although there is a chance of reaching high levels during diurnal peaks. The associated fluence is expected to remain below Active (1e8 integrated flux) levels.

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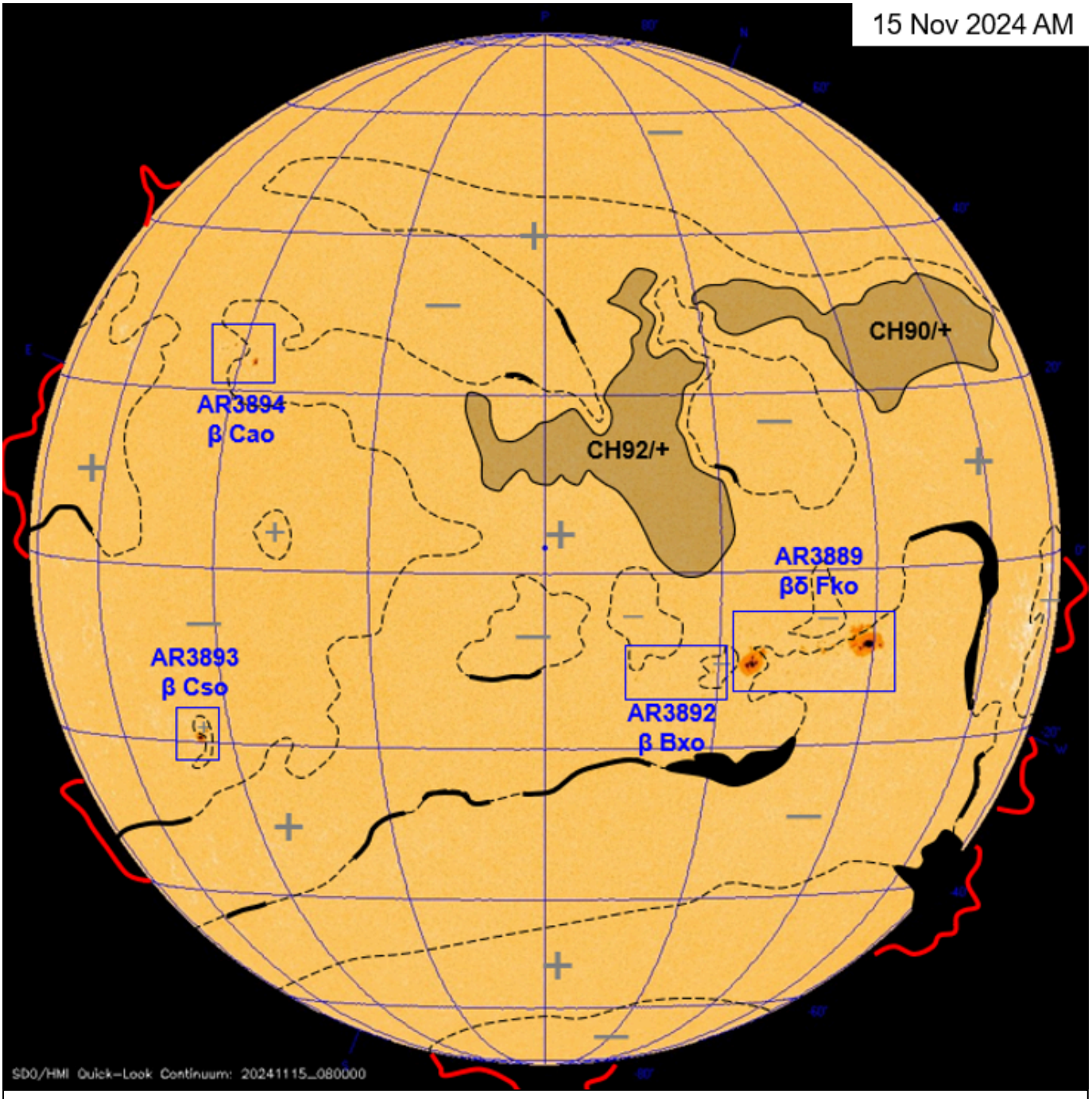
Figure 1: Solar Synoptic Map Valid 15/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

A narrow CME seen to emerge from just south of AR3889 starting from 14/1245 UTC, and another slightly larger CME from a prominence eruption on the SE limb around 14/2000 UTC. Neither CME is expected to be Earth directed. There is also a number of filaments which have shown signs of instability and warrant monitoring for potential sources of CMEs during the period.

The forecast comprises primarily of coronal hole influences. Continued transitory connections to a HSS from CH90/+ is expected, as Earth likely brushes along the southern boundary of this coronal hole, bringing a risk of slightly elevated solar wind speeds, mainly today and tomorrow. From late Day 3 (17th) there is a likelihood of elevated wind speeds of around 500km/s occurring with a connection to a HSS from CH92/+. This feature is slightly larger compared to last rotation, when speeds of around 450 km/s occurred, and a general increase also suggested by MOSWOC ENLIL output.

Geomagnetic activity is expected to be generally Quiet to Unsettled (Kp 2-3) initially, with a chance of Active (Kp 4) intervals and a slight chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals. From later Day 3 (17 Nov) activity activity expected to increase slightly, becoming Unsettled to Active (Kp 3-4) with an increased chance of isolated G1/Minor Geomagnetic Storm (Kp 5) intervals.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	10	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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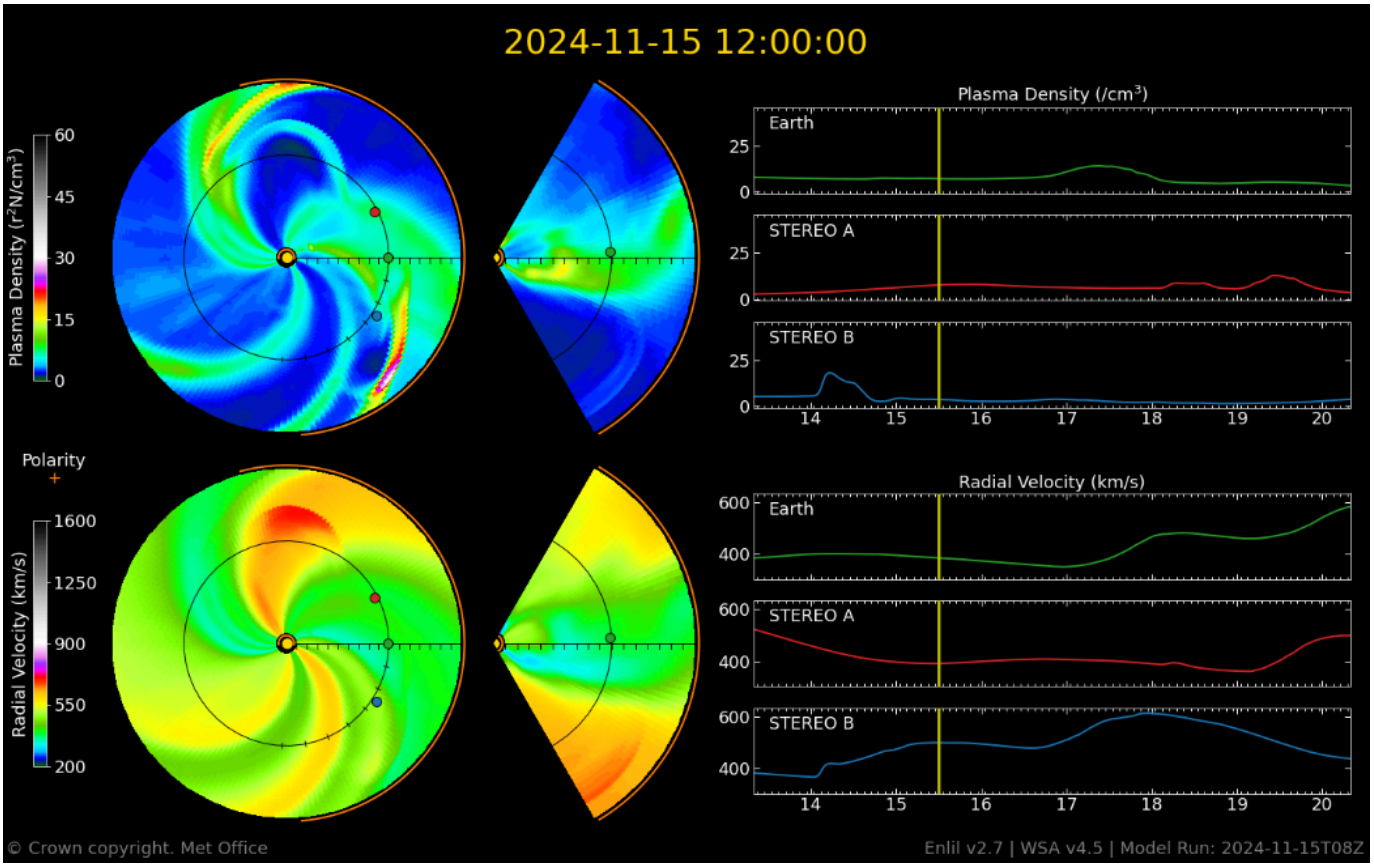
Figure 2: Latest MOSWOC ENLIL output.



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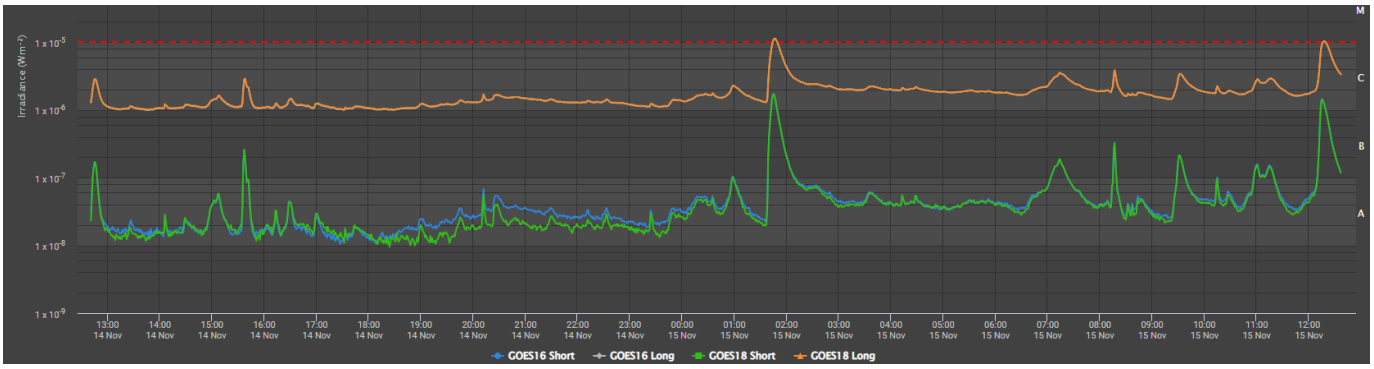
Radio Blackouts - X-Ray Flares

AR3889, in the southwest, maintains the bulk of the current flare risk, but this perhaps reducing somewhat given the apparent simplification of the region. The remaining regions are all small and simple, although the recent M-flare from the region of AR3893 shows that they can not be completely discounted. No particularly large far side regions suggested by far-side sounding data, however recurrence suggests the potential for sunspot regions to return to the visible disk from perhaps Day 2 (16 Nov) onward. This supported by some brightening of the western limb in SDO/AIA imagery and recent far-sided CMEs observed.

Overall Low to Moderate activity is expected, with a chance of isolated M-flares and a slight chance of X-flares, most likely from AR3889 to start. From Day 3 (17 Nov) in the forecast period potential returning regions increasing the forecast likelihood of significant flares.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	Yes	30	30	40	40
Very Active	R3-R5 (X Class)	No	5	5	10	10

Figure 3: Latest 24hr GOES16/18 X-ray trace.



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Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is at background levels and is expected to remain that way during the period in the absence of any significant flare activity.

There is a slight chance of S1/Minor Solar Radiation storms over the period, chiefly due to any potential significant flaring from AR3889 as it increasingly rotates across the western hemisphere.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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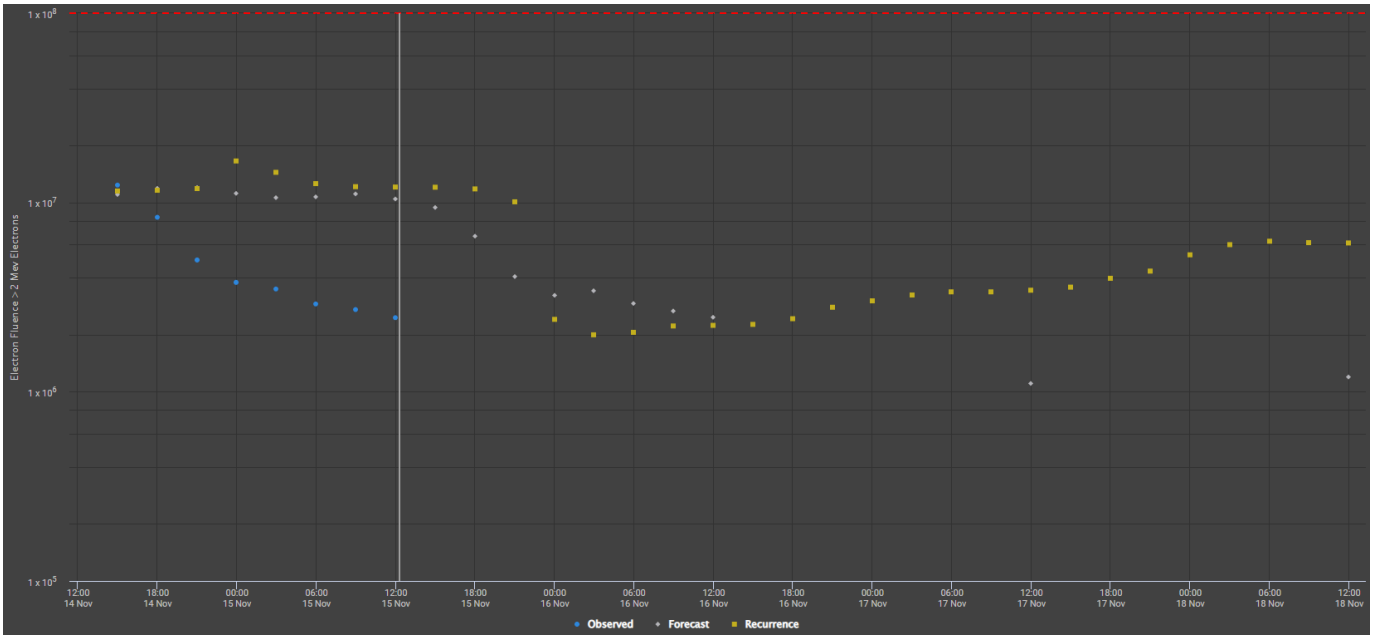
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 is at background to moderate levels, with no change expected, apart for a slight chance of temporarily reaching high levels during diurnal peaks.

The associated fluence is expected to remain below Active (1e8 integrated flux) levels, with perhaps a gradually rising trend. Therefore the guidance shown by MOSWOC's REFM model is considered reasonable guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	5
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 4: Latest MOSWOC REFM output.



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